Research Director's Report

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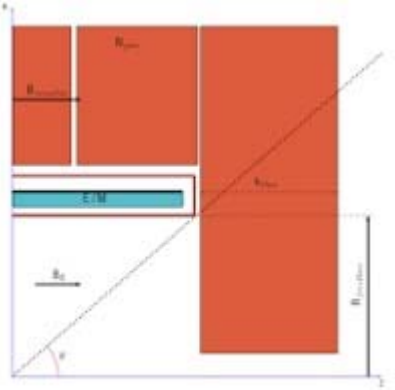
CLIC-ILC collaborations on detectors

This month's Research Director's Report was written by François Richard, co-chair of the Worldwide Study, regional detector contact for Europe

The recent meeting TILC09 in Tsukuba, with a large participation of CERN experts, was a good opportunity to measure the growing collaboration between the Compact Linear Collider Study (CLIC) and the ILC. Here I will only describe the detector aspects which are part of the Memorandum of Understanding (MOU) agreement signed between ILC and CLIC (see Barry Barish's corner in November 2008). This agreement results from the evident common interests of the two communities in machine and detector studies and the need to avoid potentially detrimental competition. In the past, physics arguments in favour of extending the centre of mass energy of the worldwide linear collider beyond 1 TeV were based on speculations. With the imminent start of LHC, not forgetting the present essential results from the Tevatron, we all agree that the choice can soon be based on solid observations.

In practice the MOU on detectors has operated very well both at the level of the groups preparing the Letters of Intent (LOIs) and of the so-called 'horizontal' collaborations on R&D with multiple participations of the CLIC team in several workshops (see for example the slides of Konrad Elsener at the last SiD meeting in March). This has naturally helped CLIC to start its efforts in view of a Conceptual Design Report (CDR) given the many developments accomplished by the large community working within the ILC detectors, in particular for what concerns the software tools – (see for instance the portal lcsim.org). Several of these codes are presently installed at CERN. Also the unique expertise at CERN in building and operating very large LHC detectors is already beneficial to the concepts presently entering a more technical phase for elaborating a realistic mechanical integration. These fruitful interactions have led to further formal agreements. It is notable, for example, that CERN physicists have signed the three LOIs of the ILC detector concepts and are joining the CALICE collaboration (Calorimeter for the Linear Collider Experiment).


Parametric model for the magnet coil and yoke (from Alain Hervé). This concept is common to CMS, ILD, SiD and CLIC.

How come that CLIC and ILC can share the same concepts? In a few words one can say that ILC detectors are pushing very hard on calorimetry performances and are using the most advanced capability to construct large superconducting solenoids. Indeed there seems to be a general consensus between CLIC and ILC to envisage a CMS type superconducting solenoid (see figure) containing both electromagnetic and hadronic calorimeters. This choice is essential since it basically drives the cost of these detectors. Also, as was indicated by an early study, the 'particle flow' philosophy developed within ILD and SiD detector concepts can reconstruct precisely particle jets up to 500 GeV which is adequate to cope with physics analysis up to 3 TeV. The DREAM calorimetry philosophy developed in the 4th concept offers a complementary approach which may even go beyond this limit.

More challenging seems the time structure constraints of CLIC with a bunch every half a nanosecond, and the incoherent pairs which increase by an order of magnitude at 3 TeV (see the talk given at TILC09 by Wolf-Dieter Schlatter). Is it possible to resolve or at least to 'time stamp' the information of a bunch train in

the tracker devices? The advanced R&D needed on these issues can also benefit ILC detectors where the level of occupancy at low radius and in the forward region will already improve with bunch stamping.

What are the next steps for these efforts? Exchanges will go on – the next meeting of the CLIC-ILC Executive Committee is on 12 June at CERN. Of course most importantly we all await a successful start of LHC, which will allow us to activate the political process for a linear collider and give us by 2012 the necessary clues to define the overall strategy.

-- François Richard